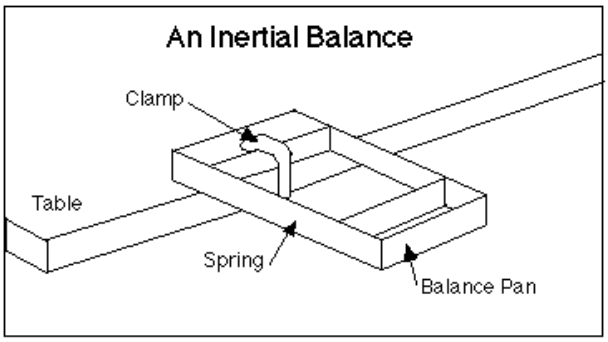
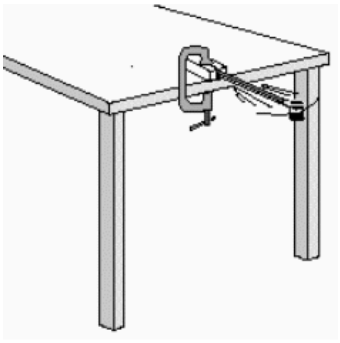
## Newton's Second Law of Motion Lab —The Inertial Balance

**Name _____ section _____**



**Materials:**

**Inertial balance**

Objects of unknown mass; Data table ; Graph paper, ruler, and pencil; 50, 100 and 200 gram brass weights; Large rubber bands; C-clamp; Stopwatch

**Procedure**

1. Read the attached material about inertial balances. Copy the data table into your science notebook.

2. Attach the inertial balance to the edge of your desk
3. Using the rubber bands, attach a 100 gram weight and find the time for 10 cycles.

**NOTE: Be sure to attach your weight securely to the outside of the balance. If your weight moves back and forth on the balance, you will affect the accuracy of your timing.**

4. Write this in your data table under "trial 1"

5. Repeat twice more for a total of three trials. Enter the data in the appropriate place on your data table.
6. Find the average time for 100 grams and ten cycles. Enter these data into your data table.
7. Using the rubber bands, attach 150 grams in brass weights and repeat the three trials noted above. Enter the appropriate data and average into the proper places in the data table.
8. Using the rubber bands, attach 200 grams in weights and repeat the three trials noted above. Enter the appropriate data and average into the proper places in the data table.
9. Use the graph paper given to your group to create a graph using the three points from your data table:
   a. 100 grams b. 150 grams c. 200 grams
10. NOTE: Time is always the independent variable and goes on the "x" axis.
11. Each group will be given one object of unknown mass. Place the unknown on your inertial balance and find the average time for 10 cycles.
12. Use your graph to determine the mass of the unknown weight.
13. Use a triple beam balance to see how accurate your measurements were.

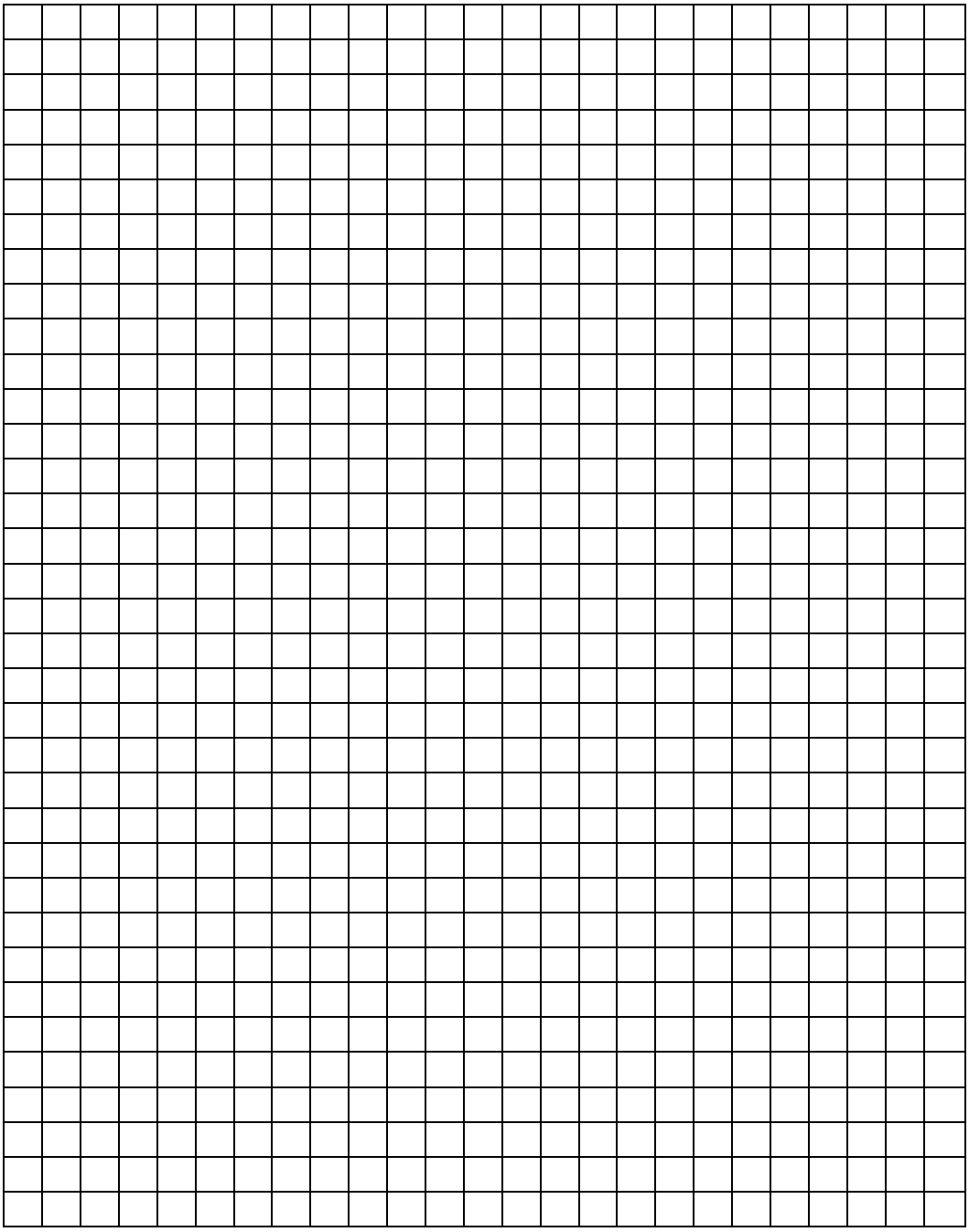
| Amount of | Time for 10 | Time for 10 | Time for 10 | Average Time |
|---|---|---|---|---|

| weight | cycles (trial 1) | cycles (trial 2) | cycles (trial 3) | |
|---|---|---|---|---|
| **100 grams** | | | | |
| **150 grams** | | | | |
| **200 grams** | | | | |
| **Unknown** | | | | |
| **Estimated mass of unknown:** | | | **Actual mass of unknown:** | |

**<u>Student version of the procedure</u>: (use past tense and "we")**

# Inertial Balance Graph

**Mass of object (grams)**



**Time in Seconds for 10 Cycles**

**Observations**

**1.** What happened to the period of the inertial balance when the mass of the weights on the end was increased?
_____

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**Inference**

**1.** If the force on an object stays the same and the mass is increased, what happens to the acceleration?
_____
_____

**Wrap Up Questions**

1. Will this technique for measuring mass work in weightless space?
   Why?_____
   _____
   _____
2. Why was it necessary to use rubber bands?
   _____
   _____
3. Would the length of the inertial balance spring make a difference in the results? How?
   _____
   _____
4. What are some of the possible sources of error in measuring the cycles?
   _____
   _____
5. What does a straight line in the calibration graph imply?
   _____
   _____
6. Does the inertial balance depend upon gravity? _____ Why or why not?
   _____
   _____
7. What does this balance have to do with inertia?
   _____
   _____
8. How did your estimate of the mass of the unknown compare with the actual mass of the unknown?
   _____
   _____